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Influence of the FFLO-like state on the upper critical field of a superconductor/ferromagnet bilayer: Angular and temperature dependence

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Abstract

© 2016 American Physical Society.We investigated the upper critical magnetic field Hc of a superconductor-ferromagnet (S/F) bilayer of Nb/Cu41Ni59 and a Nb film (as reference). We obtained the dependence of Hc and Hc (perpendicular and parallel to the film plane, respectively) on the temperature T by measurements of the resistive transitions and the dependence on the inclination angle θ of the applied field to the film plane, by nonresonant microwave absorption. Over a wide range, Hc and Hc show the temperature dependence predicted by the Ginzburg-Landau theory. At low temperatures and close to the critical temperature, deviations are observed. While Hc(θ) of the Nb film follows the Tinkham prediction for thin superconducting films, the Nb/Cu41Ni59-bilayer data exhibit deviations when θ approaches zero. We attribute this finding to the additional anisotropy induced by the quasi-one-dimensional Fulde-Ferrell-Larkin-Ovchinnikov (FFLO)-like state and propose a new vortex structure in S/F bilayers, adopting the segmentation approach from high-temperature superconductors.

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